Instructions: Try these problems from the textbook as practice (answers below).

Problems

3-8. Find the length of the curve:

3. $\mathbf{r}(t) = \langle t, 3\cos t, 3\sin t\rangle$, $-5 \le t \le 5$
5. $\mathbf{r}(t) = \left\langle \sqrt{2}t, e^t, e^{-t} \right\rangle$, $0 \le t \le 1$
7. $\mathbf{r}(t) = \mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$, $0 \le t \le 1$

13. Let C be the curve of intersection of the parabolic cylinder $x^2 = 2y$ and the surface $3z = xy$. Find the exact length of C from the origin to the point $(6, 18, 36)$.

15. Find the arc length function for the curve $\mathbf{r}(t) = (5-t)\mathbf{i} + (4t-3)\mathbf{j} + (3t)\mathbf{k}$ measured from the point $P(4, 1, 3)$ in the direction of increasing t and then reparametrizing the curve with respect to arc length starting from point P. Find the point 4 units along the curve (in the direction of increasing t) from P.

17. Suppose you start at the point $(0, 0, 3)$ and move 5 units along the curve $x = 3\sin t, y = 4t, z = 3\cos t$ in the positive direction. Where are you now?

Answers

1. $2\sqrt{21}$
3. $10\sqrt{10}$
5. $e - e^{-1}$
7. $\frac{1}{27}(13^{3/2} - 8)$
13. 42
15. $s(t) = \sqrt{26}(t-1)$, so $\mathbf{r}(t(s)) = \left\langle 4 - \frac{1}{\sqrt{26}}s, \frac{4}{\sqrt{26}}s + 1, \frac{3}{\sqrt{26}}s + 3 \right\rangle$. $\mathbf{r}(t(4)) = \left(4 - \frac{4}{\sqrt{26}}, \frac{16}{\sqrt{26}} + 1, \frac{12}{\sqrt{26}} + 3\right)$
17. $(3\sin(1), 4, 3\cos(1))$